Effect of Cosmetics on Skin & Nail Microflora

Summer internship for the partial completion of M.Sc. Microbiology

By

Sarmistha chakraborty
Reg.No-230010436814
ID- 2322211001043
Sem- IV ,M.Sc Microbiology
Dept. Of Microbiology

Sister Nivedita University

Under the supervision of

Dr. Kirat Kumar Ganguly
Asst. Professor
HOD, Dept. Of Microbiology

Micheal Madhusudhan Memorial College
Durgapur

Michael Madhusudan Memorial College

Affiliated to Kazi Nazrul University, Asansol
(Government Aided UG/PG College)
Kabi Guru Sarani, City Centre,Durgapur -713216 W.B.
(Assessed & Accredited by NAAC in Cycle III, Grade - B +)

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I wish her career success.

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Principal
(Dr. G. M. Helaluddin)
Michael Madhusudan Memorial College
Durgapur

Principal
MICHAEL MADHUSUDAN MEMORIAL COLLEGE
City Centre,Durgapur-713216

Date:03/06/25

Ph. No.: 0343 2604084, 2566700; E-mail: principalmmmc@gmail.com; contact.mmmc@gmail.com; Website: www.madhusudancollege.in

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This is to certify that Sarmistha Chakraborty, Student of M.Sc. Microbiology has completed the project entitled "Effects of Cosmetics and Antimicrobial Peptide on Skin Microflora" under the supervision of the undersigned, as part of her curriculum-based dissertation for the partial fulfilment of M.Sc. Degree in Microbiology from Sister Nivedita University at the Department of Microbiology of Michael Madhusudan Memorial College, Durgapur.

I wish her career success.

03/07/2025

Dr. Kirat Kumar Ganguly,
Assistant Professor,
HOD Microbiology
Michael Madhusudan Memorial College
Durgapur

Date:-.....

DECLARATION BY THE STUDENT

I hereby declare that the work which is being presented in this dissertation entitled "**Effects of Cosmetics on Nail and Skin Microflora"** in partial fulfilment of the requirements for the award of the degree of Masters of Science in **Microbiology** is an authentic record of my own work carried out during the period from **February 25** to **May 25** under the supervision of **Kirat Kumar Ganguly**, **Department of microbiology**, **Michael Madhusudan Memorial College**

I acknowledge that I have read and understood the UGC regulations, 2018 (*Promotion of Academic integrity and Prevention of Plagiarism in Higher Educational Institutions*).

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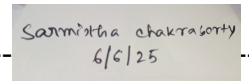
-------- 

(Signature of the students with Date)

Name of the Student--- sarmistha Chakraborty

Registration no. -- 230010436814

Department of Microbiology

SISTER NIVEDITA UNIVERSITY
সিস্টার নিবেদিতা বিশ্ববিদ্যালয়

DG Block - 1/2, Action Area I, New Town, Kolkata - 700156, West Bengal, India.

DEPARTMENT OF BIOTECHNOLOGY & DEPARTMENT OF MICROBIOLOGY
জৈব প্রযুক্তি বিভাগ ও অণুজীব বিদ্যা বিভাগ

TO WHOM IT MAY CONCERN

This is to certify that the project report titled " **Effects of Cosmetics on Nail and Skin Microflora",** submitted by Ms **Sarmistha chakraborty** (Registration No. **230010436814** Enrolment No. **2322211001043**) to the Department of Microbiology, School of Health Science and Translational Research at Sister Nivedita University, Kolkata, is a bona fide record of research conducted by him/her for the partial fulfillment of the requirements for the Master of Science degree.

Date: 6/6/25

Place: Newtown, Kolkata

Signature of Head of the Department

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Sarmistha Chakraborty

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Abbreviations- MHA agar, Glycolic acid, Glutathione, NA, NB, Cavity slide, PBS, OD, IMViC.

Abstract

The skin is the largest organ of the human body and serves as a vital protective barrier against damage from the external environment damage. Human skin and nail is populated by various microorganisms, so called microbiota, such as bacteria, virus, yeasts, fungi, and archaea. The skin microbiota is in constant contact with the surrounding environment which can alter its eubiotic state. Recently it has been also observed that the applications of cosmetic products can alter the balance of the skin microbiota. Following injury, traumatized skin tissue undergoes dynamic phenotypic changes driven by progressive reoxygenation and the release of cytokines and growth factors, which activate key reparative mechanisms. This study explores the therapeutic potential of **glutathione and glycolic acid,** two compounds widely utilized in medical and cosmetic applications for enhancing skin repair and regeneration. Glutathione is the most abundant non-protein thiol in living organisms and Glycolic acid, a naturally derived alpha hydroxyl acid, used in dermatological formulations for its exfoliating and skin renewing properties. Due to its important antioxidant role, it is widely used in the cosmetic industry. This study explored the microbial presence and behaviour from human skin and nail samples, with a focus on understanding bacterial growth, motility, and response to both cosmetic and natural antimicrobial agents. The finding suggest that both natural and synthetic substances influence bacterial growth differently, with neem and aloe based preparations showing promising antimicrobial activity. This work not only supports further exploration of plant based antimicrobial agents but also highlights the microbial risks with common surfaces like nail and skin.

Keywords- Bacterial growth, NA, NB, PBS, OD, Gram staining, Bacterial motility, Dot inoculation, IMViC, cosmetic-microbe interaction.

Contents – Introduction, background, review of literature, materials and methods, results and discussion, conclusion, acknowledgement, references, plagiarism report.

1.Introduction

The skin is the largest organ of the human body and serves as a critical protective barrier against environmental insults, pathogens, and physical damage (Proksh et al.,2008). When the skin is injured, it undergoes a complex wound healing process involving inflammation, proliferation, and tissue Remodelling (Gutner et al.,2008). During this process, phenotypic switches occur in response to progressive reoxygenation and the release of cytokines and growth factors, which activate reparative mechanisms (Eming et al.,2014).

Given the importance of efficient wound healing, various therapeutic agents have been explored to enhance skin repair. Among these, **Glutathione** —a potent antioxidant —has gained attention for its role in reducing oxidative stress and promoting tissue regeneration (Son et al.,2014). Additionally, **glycolic acid** and alpha-hydroxy acid are widely used in dermatology and cosmetic industries due to their exfoliating properties and ability to stimulate collagen synthesis (Kornhauser et al., 2010). The combination of these compounds may offer a synergistic effect in improving skin repair mechanisms.

This study investigates the potential of glutathione and glycolic acid in enhancing the reparative processes of traumatized skin tissue, considering their established roles in medicine and cosmetics.

2. Background

Cosmetic ingredients play a role in shaping the skin microflora— the diverse mix of bacteria and microorganisms that live on our skin. while cosmetics are designed to improve how our skin looks and feels, some ingredients can throw off this delicate balance. They might reduce the variety of microbes or tip the scale between good and bad bacteria, which could lead to skin problems over time. Using too many cosmetics can throw off the natural balance of bacteria on the skin. Some ingredients in cosmetics can feed certain bacteria on the skin, which might cause those microbes to grow too much and throw things out of balance.

3. Review of Literature

The skin, being the **largest organ** of the human body, constitutes the first line of defence against a variety of external insults, including microbial invasion, chemical exposure, and physical injury. It plays a critical role in maintaining homeostasis, regulating temperature, and enabling sensory perception (Proksch et al., 2008). Upon injury, the skin initiates a **complex and highly regulated repair process**, characterized by inflammatory, proliferative, and remodeling phases (Eming et al., 2014). During this repair process, **reactive oxygen species (ROS)**, cytokines, and growth factors modulate cellular responses including migration, proliferation, and extracellular matrix remodeling (Gurtner et al., 2008).

Oxidative stress plays a dual role in wound healing. While **moderate ROS levels** act as secondary messengers in cell signaling pathways that drive angiogenesis and tissue regeneration, excessive ROS can cause cellular damage and impair healing (Schäfer & Werner, 2008). Thus, **antioxidant therapy** has garnered attention as a strategy to restore redox balance and enhance skin regeneration.

Glutathione (GSH) is a tripeptide composed of glutamine, cysteine, and glycine and serves as a major **intracellular antioxidant**. It regulates cellular redox status, detoxifies xenobiotics, and protects cells from oxidative damage (Wu et al., 2004). Studies have demonstrated that topical or systemic administration of glutathione enhances wound healing by reducing oxidative stress and inflammation (Forman et al., 2009). GSH also modulates the activity of transcription factors such as NF-κB and AP-1, which are involved in the expression of pro-inflammatory cytokines during the early phase of wound healing (Moini et al., 2002). Additionally, glutathione supports **fibroblast proliferation** and **collagen synthesis**, thereby accelerating the repair process (Pompella et al., 2003).

Moreover, glutathione is commonly employed in **dermatology and cosmetology** due to its **skin-lightening** and **anti-aging** properties, primarily by inhibiting melanogenesis and neutralizing free radicals (Handog et al., 2016). These properties further extend its relevance in enhancing skin recovery post-injury.

Glycolic acid (GA), an alpha-hydroxy acid (AHA) derived from sugarcane, is widely used in dermatological and cosmetic procedures. GA promotes **epidermal turnover** and enhances **dermal matrix remodeling** by disrupting corneocyte adhesion and stimulating the production of collagen and glycosaminoglycans (Ditre et al., 1996). Its low molecular weight allows deep penetration into the skin, making it effective in treating photoaging, acne, and hyperpigmentation.

Recent studies highlight the **therapeutic potential of GA in wound healing**, where it facilitates **keratinocyte migration**, **angiogenesis**, and **re-epithelialization** (Bernstein et al., 2001). Additionally, glycolic acid's ability to modulate matrix metalloproteinases (MMPs) and cytokines may contribute to reduced scar formation and improved tissue remodeling (Kornhauser et al., 2010).

Few studies have explored the **combined therapeutic effects** of glutathione and glycolic acid. However, given their individual properties—glutathione's **antioxidant and anti-**

inflammatory actions and glycolic acid's **exfoliative and regenerative** capabilities—their **synergistic application** could offer enhanced outcomes in skin repair. This combination may address both **oxidative stress** and **structural remodeling**, crucial aspects of the wound healing cascade.

Gaps in Literature and Future Direction

While the individual roles of glutathione and glycolic acid in skin health are well-documented, there is a **paucity of research** exploring their **synergistic effects** on injured or pathologically altered skin. Investigating the **molecular mechanisms** by which these agents influence **cytokine release**, **growth factor activation**, and **angiogenesis** may yield novel therapeutic strategies for chronic wounds, surgical recovery, and dermatologic disorders.

4. Hypothesis& Objective

Hypothesis

The combined application of glutathione and glycolic acid enhances skin repair and regeneration more effectively than either agent alone, through synergistic modulation of oxidative stress, cytokine release, and extracellular matrix remodeling.

Objectives

Primary Objective:

- To evaluate the **therapeutic efficacy** of combined glutathione and glycolic acid treatment in enhancing skin repair and regeneration following injury.

Secondary Objectives:

1. To assess the **individual effects** of glutathione and glycolic acid on wound healing parameters such as re-epithelialization, fibroblast proliferation, and collagen deposition.
2. To analyse the **synergistic or additive effects** of co-application of glutathione and glycolic acid in modulating wound healing processes.

5. Materials and Methods

5.1.a **Sample preparation and Inoculation :-** Materials including 5petriplate, 2petriplate, 2 Test tube, microtips, Cotton buds, spreader, PBS, and MHA(Muller Hinton Agar) were autoclaved. After Autoclave, all materials were carefully moved into the Laminar airflow while maintain sterile condition. The MHA(Muller Hinton Agar)was poured into the sterile Petri plates and allowed to solidify. Meanwhile, 5ml of PBS was dispensed into each of the two sterile Test tubes. Skin and nail swab samples were collected for microbial analysis .Two swabs were taken from the forehead and combined in one tube containing PBS(Phosphate

Buffered Saline), labelled as PBS1. Another swab was taken from fingernail and placed into a separate tube, labelled PBS2. From each tube 1mL of the suspension was carefully transferred onto Muller Hinton Agar(MHA) plates. Specially, PBS1 was used to inoculate plates 1 and 3, while PBS2 was used for plates 2 and 4. To ensure the results could accurately interpreted, one additional MHA plate was serve as a control, helping to confirm that any microbial growth observed on the test plates was due to the samples themselves and not contamination. Each plate was evenly spread using a sterile.

5.1.b **Subculture and Gram staining**: A colony from the previously streaked plate was selected and inoculated into 4NB(Nutrient Broth) test tubes. The tubes were incubated overnight at 37°C. Gram staining and microscopy were also performed for morphological analysis.

5.1.c **Antibacterial Testing setup:** After incubation visible growth confirmed successful culture. Meanwhile 5petriplate were prepared using Nutrient Agar (NA). Once it solidified, a sterile borer was used to create 16 wells across 4plates. Cosmetic solutions were prepared in centrifuge tubes using a variety of ingredients to test their effects. The components included glutathione known for its antioxidant; glycolic acid and a commercial foundation product to represent typical cosmetic use. PBS used as a control to provide a baseline for comparison. Each was dissolved in 2mL of sterile water. Solution were poured into wells, carefully labelled (Glycolic acid , foundation, Glutathione, PBS) and plates were incubated overnight.

5.1.d **Nail Sample and Subculture :-** Bacterial growth from the nail-derived plates was confirmed. Two new NA plate

were prepared and quadrant streaking was performed to isolate colonies. Plates were incubated overnight.

5.1.e **Microscopic Motility check:**- Heavy Bacterial growth was observed. A small amount of Bacterial inoculum was taken directly from overgrowth streak plates Using a sterile loop. A drop of sterile water added to the bacteria to create suspension. The mixture was carefully placed on a cover slip. The cover slip was then inverted onto **Cavity slide**(a slide with a

shallow well). This method ideal for observing bacteria movement Under the microscope. Using a light microscope, the sample was observed for active motility —typically seen as darting, spanning or gliding movement Under high power(40x, 100x with immersion oil).

5.1.f **Observation and subculture :-**

after incubation visible microbial growth was observed on the inoculated MHA plates. Sample were taken for Gram staining, followed by microscopic examination. Simultaneously, 4new petri plates and 100mL of MHA were autoclaved and poured into sterile plates. Using an Inoculation loop, Bacterial cultures from the previously grown MHA plates were

transferred onto the new plates Using quadrant streaking method for colony isolation. These plates were incubated again at 37°C for 48 hour. After incubation, the plates were sealed with parafilm and stored 4°C.

5.1.g **Dot Inoculation on Nutrient Agar :-** while microscopy was being performed, another Experiment was set up to access Bacterial growth pattern and spreading ability: A total of 50mL of nutrient agar was prepared and evenly poured into two petri plates. Once the agar had solidified ,a small 'dot' inoculation was carefully made at the center of the plate. One of the plates was inoculated with a sample taken from nail1 streak plate, while the other received an inoculum from the nail3 streak plates. Both plates were then incubated overnight at 37°C, allowing time to observe how the bacteria spread outward from the initial point of contact. The dot Inoculation gives visual insight into how aggressively the bacteria can grow and spread—useful for understanding their nature and potential virulence.

5.1.h **Antibacterial Agent Sensitivity Test Setup :-**

To further investigate bacterial behaviour , 100mL of nutrient broth was autoclaved to ensure complete sterility. The sterilized broth was then divided into six sterile test tubes, with each tube receiving 9mL of NB. These tubes were organized into three different groups based on their contents and purpose. The first group served as blank controls and contained only NB without bacterial inoculum. These were used to confirm sterility and to establish a baseline optical density(OD) reading. The second group consisted of two test tubes, each containing 9mL of NB, 1mL of PBS , and 1mL of test compound either glutathione or glycolic acid. These were set up to determine whether these compounds have any effect on bacterial growth in absence of bacteria. The third group included two test tubes that each received 9mL of NB along with a loopful bacterial culture. These served a positive control to monitor normal bacterial growth in plain nutrient broth. All tubes are incubated overnight at 37°C ,preparing for OD measurement to evaluate bacterial growth with and without the test compounds. Here's OD measurement results organized into clear table format:

Sample	OD reading 1	OD reading 2
Blank1	0.00	0.00
Nail1+Glutathione	0.07	0.03
Nail3+Glycolic acid	0.15	0.26

To continue the experiment , 24 Eppendorf tubes were prepared by adding NB ,a bacterial inoculum ,and the test compound glycolic acid –nail3 to each tube. PBS was also added to all the tubes to maintain consistency. Once the mixture were prepared , all tubes were clearly labelled for easy identification and then incubated at 4° to observe bacterial behaviour under cold conditions. From these 24tubes samples numbered 3 and 6 were selected for further analysis. These two samples were carefully plated onto a total of 8petri plate to monitor their

growth and colony formation. All plates were incubated under controlled condition to allow bacterial colonies to develop, providing into the effect of glycolic acid –nail3 refrigerated incubation.

5.1.i **preparation of Natural Extract Samples**:- Six eppendorf tubes were prepared, each containing 1mL of PBS as a base. Different test samples were then added to the tubes to explore their potential antimicrobial properties .The samples included commercially available aloe vera gel, freshly extracted raw aloe vera gel, a neem based facial cleanser, and neem leaves extract. Additionally bacterial cultures from Nail1 and Nail3 were also added to two of the tubes. After mixing all six tubes were labelled accordingly and stored at 4°C to preserve the samples and observe any changes under cold condition.

5.1.j **Initial Antibacterial Testing using Natural products:** Four NA plates were prepared. Nail1 culture was spread on two plates and Nail3 culture on the other two. After spreading wells were bored into each plate, and the prepared natural extracts(Aloe Vera gel, Neem cleanser , raw Aloe Vera and neem leaves extract) were introduced into the wells. Plates were incubated overnight at 37°C.

5.1.l **Observation of inhibition zones** :- Visible zones of inhibition were observed around the wells, suggesting Antibacterial activity of some natural extracts. To further validate these findings, four additional NA plates were prepared .Two designed for the Nail1 and two for Nail3 . Each plates featured a single central bore, into which one the test substances was carefully added; neem extract, neem cleanser, raw aloe vera gel, and alo vera gel (shop). This setup aimed to closely examine how each natural sample influenced bacterial growth from the nail- derived cultured under controlled condition.

5.1.m **Antibacterial Activity Confirmed:** clear zones of inhibition were especially prominent in Nail1 samples, indicating a stronger antimicrobial effect of the test substances, particularly neem and Aloe vera derivatives.

5.1.n **Sub culturing :** Two new NA plates were prepared quadrant streaking using Nail1 and Nail3 bacterial cultures to isolate pure colonies. Plates were incubated overnight

5.1.o **Colony Formation** : well-formed and Isolated bacterial colonies were observed on both nail plates ,confirming viability and successful culture.

5.1.p **IMViC** :

Indole Test- This test checks if bacteria can break down the amino acid **tryptophan** to produce Indole. Grow the bacteria in tryptophan Broth for 24hours at 37°C and then add a few drops of Kovac's reagent. Red ring on the surface = Indole positive (example -. *E.coli*) No red ring = Indole negative (example - Klebsiella)

Methyl red (MR) test -This test tell if bacteria produce a lot of acid from glucose fermentation. Inoculate bacteria into MR-VP broth and incubate for 24-48 hours.

Red color = MR positive (example - *E.coli*) ,Yellow color =MR negative

(example- Enterobacter)

Vogus-Proskauer (VP) Test - Detects production of acetone, a neutral byproduct of glucose fermentation. Use same MR-VP broth and then add 5 drops of **Barritt's reagents A&B** , shake and let it stand for 15 minutes.

Red color= VP positive (eg., Enterobacter) , No color change = VP negative (eg., *E.coli*)

Citrate utilization test - This test checks if the bacteria can use Citrate as their only carbon source. Inoculate bacteria onto **Simmons Citrate agar** slant and then incubate at 37°C or 24-48 hours.

Blue color = citrate positive (eg., klebsiella), Green color = citrate negative (eg., *E.coli*)

5.1.q In this Experiment We explore the antimicrobial effects of two natural substances *Neem cleanser* and *Aloe vera* —on two different nail samples. Here we used five NA plates as testing ground .Each nail was carefully placed onto the agar surface and small wells were made in the plates to add test substances. To prepare the test solution, Neem cleanser and Aloe vera were mixed with Phosphate Buffered Saline (PBS) in different ratios to check concentration affects antimicrobial activity.

By observing the area around the wells we could see whether the Chemicals were effective — looking for clear zones where bacteria couldn't grow.

Plate Setup & Sample Distribution

Plate1	Nail1	Neem cleanser+PBS (50:50)	Clear inhibition zones observed
Plate2	Nail1	Aloe vera +PBS (50:50)	No visible zone
Plate3	Nail2	Neem cleanser +PBS(50:50)	Clear inhibition zones
Plate4	Nail2	Aloe vera +PBS (50:50)	No visible zone
Plate5	Half nail1&half nail2	Neem cleanser &Aloe vera with various PBS concentration (25:75 and 12:88	Bored and PBS added result vary

PBS concentration details (used in wells)

Chemical	PBS ratio	Neem cleanser	Aloe Vera
High concentration	50:50	Yes	Yes
Medium	25:75	Yes(in plate5)	Yes
Low	12:88	Yes	Yes

Plamid DNA isolation-

To isolate plasmid DNA from transformed bacteria, we use gentle alkaline lysis method followed by ethanol preparation. The procedure begins with overnight culture of the single bacteria colony in rich medium such as LB,YT., containing the appropriate antibiotic to maintain plasmid selection. After overnight incubation culture is harvested in microcentrifuge tube and spun at maximum speed for 30sec at 4°C. The supernatant is discarded and the bacterial pellet is left as dry as possible.

The cell pellet is then resuspended thoroughly in alkaline lysis solution I, which helps in weakening the cell wall. To lyse the cells, freshly prepared alkaline lysis solution II added. This solution contain 4gm NAOH and 1pesent SDS, which together break down the cell membrane and denature proteins and chromosomal DNA. The tube is gently inverted to mix but not vortexed, and the mixture is kept on ice.

To neutralize the lysate added ice cold Alkaline Lysis Solution III. This solution made from potassium acetate and glacial acetic acid, causes the precipitation of cell debris, proteins, and genomic DNA, while plasmid DNA remains in solution. After 3-5min on ice, the sample is centrifuge for 5min at 4°C, and the clear supernatant – containing plasmid DNA – is transferred to a fresh tube. A phenol: chloroform extraction can be performed to remove any residual proteins. The plamid DNA is then participated by adding 2volumes of ethanol and mixed well, then kept in room temperature. DNA is collected by centrifugation and washed with 70%ethanol to remove salts. Remove all supernatant by aspiration. Take care with this step as the pellet sometimes does not adhere tightly to the tube. Remove any beads of ethanol from the tube and store the open tube ar room temperature until the ethanol evaporated and no fluid is visible in the tube. Dissolve the nucleic acid of TE containing DNase free RNase ·°A, then vortex the solution gently for a few seconds and store the DNA at -20°C .

6. Result and observation :-

Inoculation

After overnight incubation visible microbial growth appeared on the inoculated MHA agar plates confirming the presence of active microorganisms. Samples were then collected for Gram staining, which was followed by microscopic examination to better understand the types of bacteria present. At the same time ,four petri plates were prepared by autoclaving 100mL of fresh MHA and pouring it into sterile plates. Using a sterile inoculation loop , bacterial cultures from the previously grown MHA plates were carefully transferred onto the

new plates using the quadrant streaking method to isolate individual colonies. These plates were incubated at 37°C for 48 hours, then sealed with parafilm and stored at 4°C. Observation showed significant microbial growth on the inoculated MHA plates , highlight the presence of diverse skin and nail microflora. Microscopy revealed a mix of gram positive

and gram negative bacteria, suggesting a varied bacterial community. Importantly, the blank control plate showed no growth confirming the sterility of both the materials and experimental technique. The subcultured plates displayed clear colony morphology through quadrant streaking, indicating successful isolation and the potential for further microbial identification.

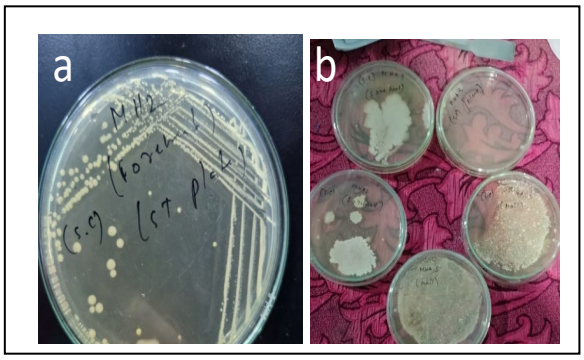


Figure1:(a) quadrant streak plate. (b) bacterial colonies of MHA plates.

Subculture and antibacterial testing

Gram staining and microscopy were also carried out to analyse the morphological characteristics of the bacterial samples. This process allowed the differentiation between Gram positive and Gram negative bacteria and provided a visual insight into the shape, size of the cell under microscope. After incubation, visible bacterial growth confirmed that the culture process was successful, particularly for nail derived samples, which showed heavy bacterial proliferation. To further study the characteristics of these bacteria ,a sample was transferred onto **cavity slide** –a special slide with a shallow well ideal for observing live bacteria. Using a light microscope under high power(40x and 100x with immersion oil), the sample was examined for signs of motility. Active bacterial movement was clearly observed, appearing as darting, gliding, or spanning motions.

In dot inoculation experiment, the nail1 sample showed significant growth. Initially the inoculation spot measured approximately 0.9cm in length and 1cm in breadth. After overnight incubation, colony expanded dramatically to 8.4cm by 8.4cm. this rapid and uniform spreading from the central point of inoculation highlighted the strong motility and growth potential of the bacterial strain present in the sample. Here's OD measurement results organized into clear table format:

Sample	OD reading 1	OD reading 2
Blank1	0.00	0.00
Nail1+Glutathione	0.07	0.03
Nail3+Glycolic acid	0.15	0.26

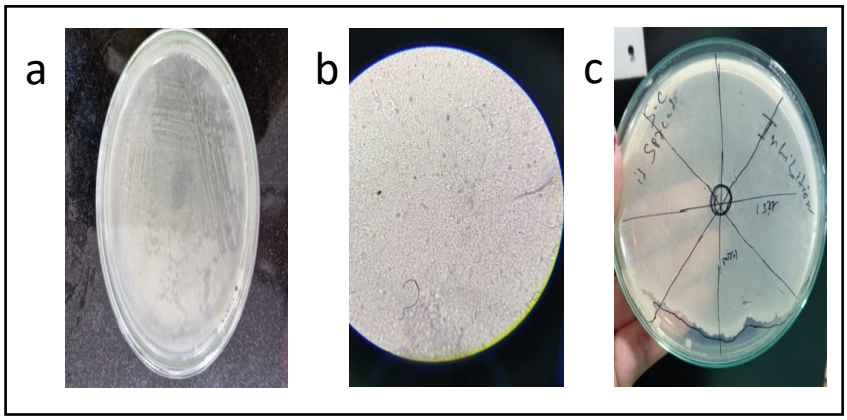


Figure2 : (a)bacterial growth plates of nail derived samples.(b)bacterial movement visible through cavity slide.(c)Nail sample showed significant growth.

Serial dilution

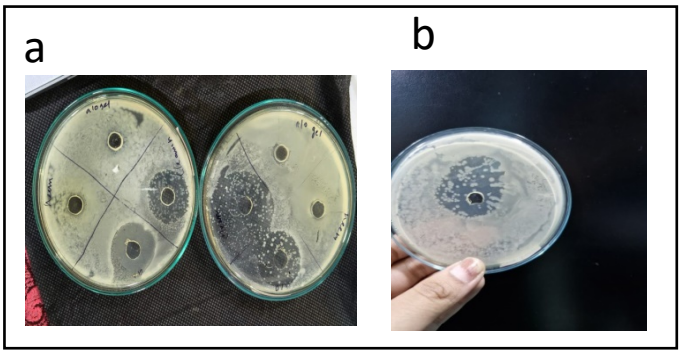
Visible microbial growth was observed on all petri plates inoculated with sample 3 and 6 . This indicates that bacteria remained viable and capable of growth despite the presence of glycolic acid, suggesting that the glycolic acid –nail3 combination did not completely inhibit bacterial activity under these condition.

Inhibition zones of neem and aloe vera

Visible zones of inhibition were observed around the wells, suggesting Antibacterial activity of some natural extracts. To further validate these findings, four additional NA plates were prepared .Two designed for the Nail1 and two for Nail3 . Each plates featured a single central bore, into which one the test substances was carefully added; neem extract, neem cleanser, raw aloe vera gel, and alo vera gel (shop). This setup aimed to closely examine how each

natural sample influenced bacterial growth from the nail- derived cultured under controlled condition.

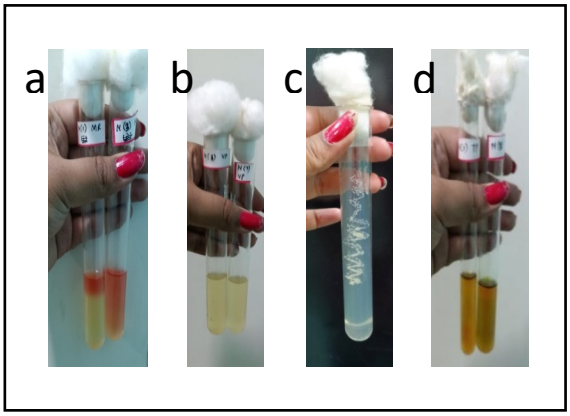
Figure3: (a)visible microbial growth observed on inoculated petri plates. (b)each plate bore and one test substances was added for clear inhibition zone.



IMViC results

The IMVIC results indicate a combination of metabolic characteristics useful for identifying members of the Enterobacteriaceae family. An indole – negative result suggests the organism does not produce tryptophanase(example- Klebsiella) . The methyl red(MR) positive result indicates stable acid production from glucose fermentation, typical of bacteria such as E.coli. A voges- proskauer(VP) negative result indicate that the organism does not produce neutral end products like acetoin(example- E.coli). Citrate test indicate positive result it means bacteria can use citrate as sole carbon source(example- klebsialla).

Figure 4: IMViC test results.



Plasmid isolation result

Plasmid isolation was successfully carried out ,and the results showed a distinct single DNA band in Nail1 sample. This indicates the presence of plasmid DNA, suggesting that sample may contain plasmid-bearing microorganisms.

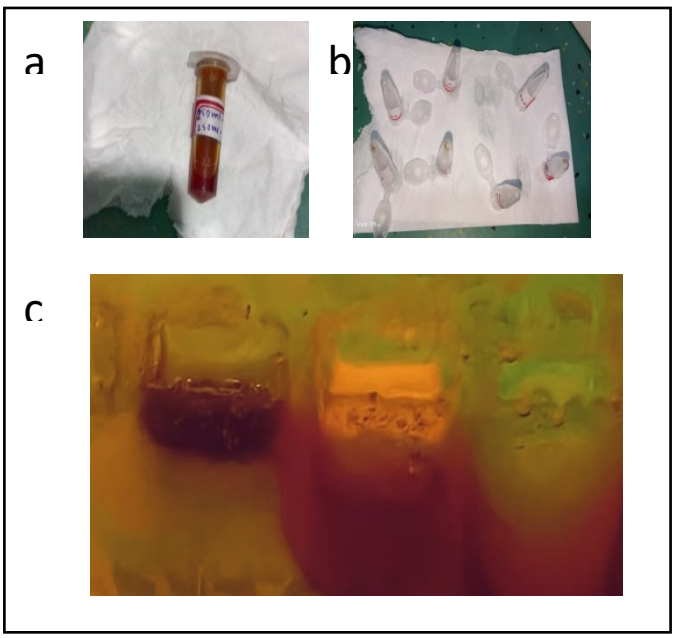


Figure 5- results indicates the presence of plasmid DNA .

7. Discussion:

Probable future directions:

To quantify oxidative stress markers (e.g., ROS levels, glutathione peroxidase activity) and inflammatory cytokines (e.g., IL-6, TNF-α) in treated versus untreated skin tissue.

To investigate the impact of the treatments on angiogenesis and matrix metalloproteinase (MMP) activity, as indicators of tissue remodeling and regeneration.

To explore the molecular pathways (e.g., NF-κB, TGF-β, MAPK signaling) influenced by glutathione and glycolic acid in the context of wound healing.

8. References

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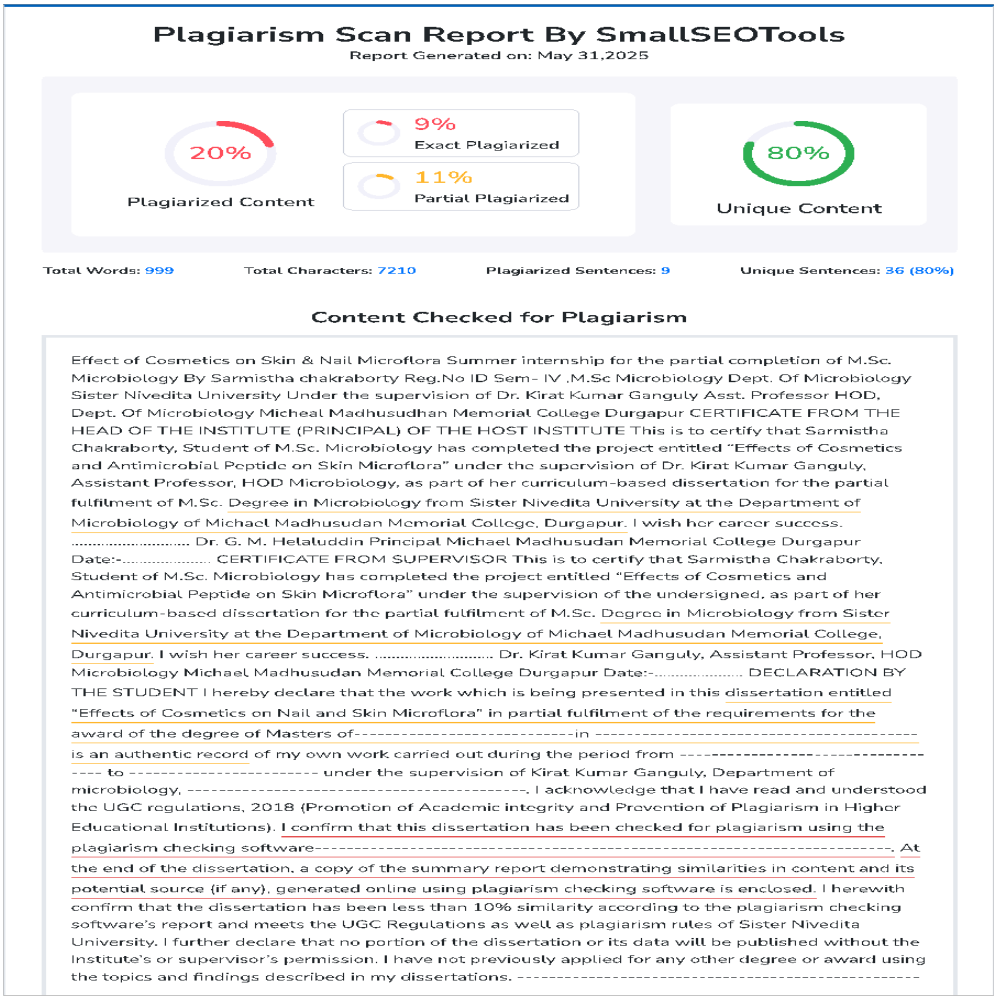
9. Plagiarism report-



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Effect of Cosmetics on Skin & Nail Microflora Summer internship for the partial completion of M.Sc. Microbiology By Sarmistha chakraborty Reg.No ID Sem- IV ,M.Sc Microbiology Dept. Of Microbiology Sister Nivedita University Under the supervision of Dr. Kirat Kumar Ganguly Asst. Professor HOD, Dept. Of Microbiology Micheal Madhusudhan Memorial College Durgapur CERTIFICATE FROM THE HEAD OF THE INSTITUTE (PRINCIPAL) OF THE HOST INSTITUTE This is to certify that Sarmistha Chakraborty, Student of M.Sc. Microbiology has completed the project entitled "Effects of Cosmetics and Antimicrobial Peptide on Skin Microflora" under the supervision of Dr. Kirat Kumar Ganguly, Assistant Professor, HOD Microbiology, as part of her curriculum-based dissertation for the partial fulfilment of M.Sc. Degree in Microbiology from Sister Nivedita University at the Department of Microbiology of Michael Madhusudan Memorial College, Durgapur. I wish her career success. ..... Dr. G. M. Helaluddin Principal Michael Madhusudan Memorial College Durgapur Date:-..... CERTIFICATE FROM SUPERVISOR This is to certify that Sarmistha Chakraborty, Student of M.Sc. Microbiology has completed the project entitled "Effects of Cosmetics and Antimicrobial Peptide on Skin Microflora" under the supervision of the undersigned, as part of her curriculum-based dissertation for the partial fulfilment of M.Sc. Degree in Microbiology from Sister Nivedita University at the Department of Microbiology of Michael Madhusudan Memorial College, Durgapur. I wish her career success. ..... Dr. Kirat Kumar Ganguly, Assistant Professor, HOD Microbiology Michael Madhusudan Memorial College Durgapur Date:-..... DECLARATION BY THE STUDENT I hereby declare that the work which is being presented in this dissertation entitled "Effects of Cosmetics on Nail and Skin Microflora" in partial fulfilment of the requirements for the award of the degree of Masters of----------in ---------- is an authentic record of my own work carried out during the period from ---------- to ---------- under the supervision of Kirat Kumar Ganguly, Department of microbiology, ----------. I acknowledge that I have read and understood the UGC regulations, 2018 (Promotion of Academic integrity and Prevention of Plagiarism in Higher Educational Institutions). I confirm that this dissertation has been checked for plagiarism using the plagiarism checking software----------. At the end of the dissertation, a copy of the summary report demonstrating similarities in content and its potential source (if any), generated online using plagiarism checking software is enclosed. I herewith confirm that the dissertation has been less than 10% similarity according to the plagiarism checking software's report and meets the UGC Regulations as well as plagiarism rules of Sister Nivedita University. I further declare that no portion of the dissertation or its data will be published without the Institute's or supervisor's permission. I have not previously applied for any other degree or award using the topics and findings described in my dissertations. ----------